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IS 8198-10 (1980): Code of Practice for Steel Cylinders for Compressed Gases, Part X: Methyl Bromide Gas [MED 16: Gas Cylinders]

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IS : 8198 (Part X) - 1980

Indian Standard

CODE OF PRACTICE FOR STEEL CYLINDERS FOR COMPRESSED GASES

PART X METHYL BROMIDE GAS

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*Indian Standard*CODE OF PRACTICE FOR STEEL
CYLINDERS FOR COMPRESSED GASES

PART X METHYL BROMIDE GAS

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(Continued on page 18)

*Indian Standard*CODE OF PRACTICE FOR STEEL
CYLINDERS FOR COMPRESSED GASES

PART X METHYL BROMIDE GAS

0. FOREWORD

0.1 This Indian Standard (Part X) was adopted by the Indian Standards Institution on 13 November 1980, after the draft finalized by the Gas Cylinders Sectional Committee had been approved by the Mechanical Engineering Division Council.

0.2 For safe handling of cylinders containing liquid methyl bromide one should be thoroughly conversant with the properties and characteristics of methyl bromide. There are several precautions and safe practices which are to be observed on account of the nature of the methyl bromide and also because of the pressure to which the cylinders are subjected.

0.3 Manufacturers, fillers, and users of the gas cylinders covered by this code should be familiar with the precautions laid down in this code in order to ensure safe and efficient operating conditions. For general information on different gases conveyed in cylinders, SP : 9-1973* may also be referred to.

0.4 For the purpose of easy reference the standard is being issued in different parts as under:

IS : 8198 (Part I)-1976

Code of practice for steel cylinders for compressed gases: Part I Atmospheric gases

IS : 8198 (Part II)-1976

Code of practice for steel cylinders for compressed gases: Part II Hydrogen gases

IS : 8198 (Part III)-1976

Code of practice for steel cylinders for compressed gases: Part III High pressure liquefiable gases

IS : 8198 (Part IV)-1976

Code of practice for steel cylinders for compressed gases: Part IV Dissolved acetylene gas

*Technical data sheet for gases conveyed in cylinders.

IS : 8198 (Part X) - 1980

IS : 8198 (Part V)-1976	Code of practice for steel cylinders for compressed gases: Part V Liquefied petroleum gas (LPG)
IS : 8198 (Part VI)-1979	Code of practice for steel cylinders for compressed gases: Part VI Liquefied chlorine gas
IS : 8198 (Part VII)-1979	Code of practice for steel cylinders for compressed gases: Part VII Ammonia gas
IS : 8198 (Part VIII)-1979	Code of practice for steel cylinders for compressed gases: Part VIII Common organic refrigerant gases
IS : 8198 (Part IX)-1980	Code of practice for steel cylinders for compressed gases: Part IX Sulphur dioxide gas
IS : 8198 (Part X)-1980	Code of practice for steel cylinders for compressed gases: Part X Methyl bromide gas
IS : 8198 (Part XI)-1980	Code of practice for steel cylinders for compressed gases: Part XI Methyl chloride gas

0.5 The precautions to be observed for ensuring safety in the use of these cylinders have been classified under the following headings:

- a) General properties of methyl bromide;
- b) Approved specifications and general guidance for manufacture;
- c) Inspection;
- d) Testing;
- e) Fitting;
- f) Filling;
- g) Marking and labelling;
- h) Storage;
- j) Handling;
- k) Transportation; and
- m) General precautions.

0.6 Manufacture, possession and use of any gas when contained in cylinders in a compressed or liquefied form is regulated under the *Gas Cylinder Rules, 1940*, of the Government of India as amended from time to time. Although the code has been prepared in consultation and agreement with the statutory authorities under these rules, should anything in

the code conflict with the provisions of *Gas Cylinder Rules*, the latter shall be adhered to.

0.7 The quantities in this standard have been expressed in technical metric units. However, in view of the introduction of International System (SI) units in the country, the relevant SI units and the corresponding conversion factors are given below for guidance:

$$1 \text{ kgf/cm}^2 = 98.066 \text{ 5 kPa (kilopascal) } = 0.980 \text{ 665 bar}$$

0.8 For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS : 2-1960*. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

0.9 In using this code, requirements of IS : 1312-1967† shall be borne in mind.

1. SCOPE

1.1 The code (Part X) covers filling, inspection testing, maintenance and use of portable steel cylinders for the storage and transportation of liquefied methyl bromide gas in cylinders, of nominal capacity up to and including 130 litres water capacity.

2. TERMINOLOGY

2.1 For the purpose of this standard, the definitions given in IS : 7241-1974‡ shall apply.

3. PROPERTIES AND PHYSICAL CONSTANTS

3.1 The properties and physical constants of methyl bromide gas are described briefly in Table 1. The vapour pressure of methyl bromide at different temperatures is given in Table 2.

3.2 Ignition Range in Air — 13·5 to 14·5 percent by volume. (This means that within the above range of concentration, the gas is capable of forming mixtures with air in which at an initial temperature of 20°C and an initial pressure of 1 atmosphere, there is propagation of ignition, started by an ignition source.)

*Rules for rounding off numerical values (revised).

†Specification for methyl bromide (first revision).

‡Glossary of terms used in gas cylinder technology.

3.3 Maximum Permissible Toxicity — 20 ppm by volume. (This is the maximum concentration in air to which nearly all workers may be exposed day after day without adverse effects.)

3.4 Suitable Materials — Suitable materials for construction of cylinders or valves for methyl bromide gas are steel, copper or brass. Unsuitable material is aluminium.

**TABLE 1 PROPERTIES AND PHYSICAL CONSTANTS OF
METHYL BROMIDE**

(Clause 3.1)

Physical classification	Colourless poisonous gas at room temperature and pressure. It is odourless except in relatively high concentrations where it has a chloroform like odour
Chemical properties:	
Flammability	It is practically non-flammable except in the narrow range 13·5 to 14·5 percent by volume in air. It is also non-corrosive
Molecular formula	CH ₃ Br
Molecular weight	94·95
Boiling point at 760 torr	4·5°C
Freezing point	-93°C
Specific gravity compared to air at 1 atm and 0°C	3·27
Specific gravity of liquid at 0°C	1·732
Critical temperature	191°C
Viscosity at 0°C	0·010 36 cP
Vapour pressure at 65°C	5·70 kgf/cm ²

4. APPROVED SPECIFICATIONS AND GENERAL GUIDANCE FOR MANUFACTURE

4.1 The cylinders shall conform to one of the specifications approved by statutory authority. A list of approved specifications for filling in this country is given in Appendix A.

4.2 Cylinders manufactured in accordance with approved specifications shall be provided with an additional wall thickness to allow for corrosion during service. It shall be borne in mind that corrosion is not related to the thickness of the container so that any additional thickness allowed for corrosion should be constant rather than a given proportion of thickness.

4.3 Further additional wall thickness shall also be considered necessary in order that the cylinder can safely withstand stresses due to horizontal acceleration and retardation in normal road transportation. The cylinder

shall be so designed that the maximum permissible equivalent stress will not be exceeded when the stresses in the cylinder due to vertical accelerations are superimposed upon the stress due to internal pressure. The vertical accelerations considered should be those occurring in normal road transport. The provisions to be made in these and other respects as well as manufacturing tolerances to be applied will generally be decided between the user and the manufacturer. If a pronounced departure from normal practice is proposed or if other unusual features arise, the statutory authority shall be consulted.

**TABLE 2 VAPOUR PRESSURE OF METHYL BROMIDE
AT VARIOUS TEMPERATURES**

(Clause 3.1)

TEMPERATURE °C	VAPOUR PRESSURE kgf/cm ²
0	0·202
10	1·315
20	1·884
30	2·503
40	3·516
50	4·570
60	5·03
70	6·58
80	9·984
90	12·796
100	15·468
110	19·124
120	23·202
130	27·983
140	32·905
150	39·022
160	45·702
170	52·073
180	60·467
190	70·310

5. INSPECTION

5.1 Inspection During Manufacture — One of the inspection agents approved by the statutory authority shall visit the manufacturing works to check and verify the following.

5.1.1 That the chemical composition and physical properties of the steel used for the manufacture of cylinders strictly conform in all respects to the required specifications and that the chemical analysis of the material has been verified.

5.1.2 That a steel maker's guarantee certificate ensuring that the steel used for making the cylinder is manufactured in accordance with the approved process is available with the manufacturer, and that the material used for making each cylinder has been examined by him and found to be sound in all respects.

5.1.3 That the mechanical properties, the wall thickness, inner and outer surfaces of the cylinders were found satisfactory and in accordance with the requirements.

5.1.4 That the length, capacity, and the mass of each cylinder were found within tolerance limit.

5.1.5 That the hydrostatic test for each cylinder had been witnessed by the inspecting authority and that there was no sign of any leakage in the cylinders.

5.1.6 That the heat treatment of the cylinders was supervised by the inspecting authority and found to be efficient and satisfactory.

5.1.7 That all cylinders which passed the above tests and are accepted have been officially stamped by him.

5.2 Inspection During Usage — All the cylinders shall be examined for the following when received for filling.

5.2.1 That the cylinders conform to one of the specifications approved by the statutory authority for use in this country.

5.2.1.1 A cylinder, either not conforming to any of the standard specifications or when the specification is not known, shall not be accepted for filling unless approved and cleared by the statutory authority.

5.2.2 That the statutory requirements regarding valves, markings, fittings and painting are complied with.

5.2.3 That the external condition of the cylinder body is sound. Any defect, such as dent, bulge, cut, gouge, corrosion, etc, which is liable to weaken the cylinder wall as certified by a competent person will render the cylinder unfit for further use. The acceptability limit of such damaged cylinder is detailed in IS : 5845-1970*.

*Code of practice for visual inspection of low pressure gas cylinders.

5.2.4 That the outlet threads of valves are in good condition. That the spindle is sound and not broken and the gland washers which shall be of good quality and compatible with methyl bromide are not worn out.

5.2.5 That the cylinder is not due for periodic inspection and testing as indicated from markings on the cylinder.

5.3 Periodic Inspection and Testing — Cylinders shall be periodical-
ly tested and inspected as follows.

5.3.1 All cylinders when received for filling shall be checked by the filler if they are due for the hydrostatic re-testing. Hydrostatic test shall be carried out in accordance with IS : 5844-1970*.

5.3.2 The cylinders are to be tested periodically as stipulated by the statutory authority (*see also* IS : 8868-1978†).

5.3.3 The testing of cylinder shall be done by a competent person.

5.3.4 All cylinders, whether new or in service, shall be carefully examined internally and externally for any damage. All protective coating and foreign matter, if any, shall be removed, where necessary, prior to such examination so that the surface can be properly examined. The damage, if any, shall be carefully ascertained, the acceptability limit of the same is detailed in IS : 5845-1970‡.

5.3.5 The internal examination shall be conducted by an efficient electric lamp which will give adequate illumination to have a clear view so that the defect, if any, can be detected.

6. DISPOSAL OF CONDEMNED CYLINDERS

6.1 Cylinders which do not comply with the requirements of inspection and testing shall be destroyed in accordance with IS : 9200-1979§.

6.2 Records of such cylinders shall be closed and kept for a period of one year.

7. FITTINGS

7.1 Cylinders shall be fitted with a valve conforming to either IS : 3224-1979|| or to any other specification approved by the statutory authority.

7.2 It shall have a suitable protection for the valve.

*Recommendations for hydrostatic stretch testing of compressed gas cylinders.

†Periodic inspection interval for gas cylinders in use.

‡Code of practice for visual inspection of low pressure gas cylinders.

§Methods of disposal of unserviceable compressed gas cylinders.

||Specification for valve fittings for compressed gas cylinders excluding liquefied petroleum gas cylinders (*second revision*).

7.3 Safety device shall not be provided (see IS : 5903-1970*).

7.4 The colour of the paint on the cylinders (see IS : 4379-1967†) shall always be maintained by periodically repainting them.

8. FILLING

8.1 While filling, the cylinder shall be filled in such a manner that the filling ratio does not exceed 1.39 (see IS : 3710-1978‡).

8.2 The amount of liquefied methyl bromide charged into each cylinder shall be determined by weighing after the cylinder has been disconnected from the line and on no account the cylinder shall be charged in excess of the filling ratio.

8.3 All the cylinders shall be carefully examined for leaks after filling. Where leaks cannot be stopped, the cylinders shall be emptied and inspected for the cause of leakage.

8.4 Emptying the cylinder shall not be accelerated by direct heating of the cylinder.

8.5 Cylinders shall be filled in an approved filling station only.

8.6 Filling staff shall identify the cylinders from their peacock blue ground colour and colour of band as black, and methyl bromide symbol CH_3Br (see IS : 4379-1967*) punched on the cylinder before proceeding to fill them. The colour coding shall be considered as secondary.

9. MARKING AND LABELLING

9.1 Marking

9.1.1 On Cylinders — Each cylinder shall be permanently marked on the valve end of the cylinder with the following markings:

- a) Serial number, identification and symbol of the manufacturer;
- b) Number of the standard to which the cylinder conforms;
- c) Test pressure;
- d) The date of hydrostatic test with code mark of the station where the test was carried out;
- e) Water capacity;
- f) Tare and gross weight;

*Recommendations for safety devices for gas cylinders.

†Identification of contents of industrial gas cylinders.

‡Specification for filling ratios for liquefiable gases contained in cylinders (*first revision*).

- g) Working pressure; and
- h) Methyl bromide symbol, CH₃Br.

9.1.2 On Valves — The following markings shall be made on cylinder valves:

- a) Number of the standard,
- b) Month and year of manufacture,
- c) Test pressure of valve, and
- d) Manufacturer's symbol.

9.2 Labelling

9.2.1 Each cylinder filled shall carry a label tacked to it detailing the name of the filling station, its location, name of gas in bold capital 'METHYL BROMIDE' and its grade, net weight and warning instructions as stipulated in *Gas Cylinder Rules*, 1940 as amended from time to time.

9.2.2 The minimum cautionary notice shall be worded as under:

WARNING

DANGEROUSLY HAZARDOUS UNDER ALL CONDITIONS,
ALWAYS STORE, UNDER LOCK AND KEY. WEAR
RUBBER GLOVES, PROTECTIVE CLOTHING AND RES-
PIRATOR WHILE FUMIGATING.

9.2.3 The containers shall also be marked with the symbols of danger of non-flammable compressed gases and for danger of poisoning as specified in IS : 1260 (Part I)-1973*. The cylinder shall also be marked with poison lable as given in Fig. 3 of IS : 1260 (Part I)-1973*.

10. STORAGE

10.1 Cylinders shall be stored in a dry ventilated place away from excessive heat or danger of fire, and protected from accumulation of snow and ice. It is preferable that cylinder storage room be fire-proof. The storage shall not be used for any purpose other than storing the cylinders.

10.2 Cylinders shall never be stored near gangways or elevators or near ventilating systems.

10.3 Dangers can be reduced by storing cylinders so that the oldest stock can be used first.

*Pictorial markings for handling and labelling of goods: Part I Dangerous goods.

10.4 Keeping the full and empty cylinders separately and storing in an orderly way will simplify handling, reduce confusion and permit frequent inspection for signs of leaks or other dangers. Valve protection hoods shall always be kept in place except when cylinders are actually being emptied.

10.5 Cylinders shall be stored in an upright position. Cylinders shall be adequately supported in the vertical position while storing and during use.

11. HANDLING

11.1 The gas shall be called only by its name.

11.2 Adequate care shall be taken in handling the cylinders so that these are not dropped or struck against each other violently.

11.3 Cylinders shall be moved on properly balanced hand trucks, preferably with rubber tyres. A clamp or chain support two-thirds of the way up the cylinder shall be used.

11.4 Hoisting of cylinders is not recommended. However, if hoisting cannot be avoided, a lifting clamp cradle or carrier shall always be used. Cylinders shall never be hoisted with lifting magnet, rope or chain sling. A cylinder shall never be lifted by the hoods as it is not strong enough to support the weight.

11.5 The cylinders shall not be used as rollers to move other equipment.

11.6 Repairing, painting or altering colour of cylinders or valves shall not be done by consumer.

11.7 Markings stamped on cylinder and valve shall not be tampered with.

11.8 Valve shall always be closed before the cylinders are moved.

11.9 Cylinder shall not be:

- a) lifted with an electromagnet;
- b) kept near elevator, gangway or in a location where moving objects can fall on it;
- c) left near a source of heat;
- d) used as rollers, supporters or for any purpose other than storing gas;
- e) kept in contact with electric wire or fitting so that it may become path of an electric circuit;
- f) kept near acid or corrosive substances;

- g) lifted by its cap;
- h) dragged or滑 on floor; and
- j) rolled over oily or greasy floor.

12. TRANSPORTATION

- 12.1** Cylinders may be shipped by truck, rail or water.
- 12.2** Cylinders shall not be loaded on vehicles in such a manner that they may bounce or strike against each other.
- 12.3** During transport, cylinders shall not project in the horizontal plane beyond the sides or ends of the vehicle.
- 12.4** Cylinder on vehicle shall be blocked or braced and secured to prevent movement or falling down.
- 12.5** There shall not be any sharp projections on the inside of the vehicle which can damage the cylinder wall.
- 12.6** Leaky or defective cylinders shall not be transported knowingly.
- 12.7** When cylinders are transported by rail it shall be done in accordance with the *Railway Red Tariff Rules*. Cylinders shall be pasted with label for dangerous and poisonous gas as recommended by the Railways.
- 12.8** The transport contractor or the personnel involved in the transport of cylinders shall be informed of the special care that has to be taken for cylinders and shall be well informed about toxicity of methyl bromide gas.

13. REMOVING METHYL BROMIDE

13.1 Connections

- 13.1.1** Outlet threads on container valves are not tapered pipe threads. Connections shall be made with yoke and adapter.
- 13.1.2** Flexible 12.7 mm copper tube, of at least 35 kgf/cm² working pressure shall be used for connections between cylinder and stationary piping.
- 13.1.3** A shut off valve suitable for liquid methyl bromide service shall be provided at the beginning of stationary piping to simplify changing of containers.

13.2 Valves

- 13.2.1** To unseat the spindle, the valve handle shall be turned anti-clockwise and the valve opened slowly.

13.2.2 One complete turn permits maximum discharge. The valve shall not be forced beyond this point.

13.2.3 If the valve is too tight to open, the packing gland nut shall be slightly loosened to free the stem.

13.2.4 Pipe wrenches or other spanners shall not be used on valve opening.

14. DISCHARGE

14.1 Cylinders discharge gas when upright and liquid when inverted.

14.2 Inverted cylinder shall be supported at the shoulders and held in place by clamps or chains about the cylinder body.

15. GAS FLOW

15.1 The rate of gas flow can be increased by improving air circulation about the container or by increasing the room temperature if it is below normal.

15.1.1 Heat shall not be applied directly to the cylinder for any reasons.

15.2 If a high rate of gas flow is required, methyl bromide shall be withdrawn as liquid and converted to gas by means of vaporizer.

15.3 Joining together or manifolding of the outlets of several cylinders to increase the flow rate shall not be done.

15.4 The amount of methyl bromide remaining in a cylinder shall be best found by comparing the weight of the cylinder with the tare weight when empty. If the container is placed on a scale during unloading, the amount remaining is known at all times.

15.5 When methyl bromide is being absorbed in a liquid, there is sometimes a tendency for the liquid to be sucked back into the container as it becomes empty. This may result in serious accidents.

15.5.1 A vacuum brake loop shall be employed whenever methyl bromide from cylinders is absorbed in a liquid.

16. GENERAL PRECAUTIONS

16.1 Cylinders shall be handled by properly instructed and trained persons.

16.2 Attempts shall never be made to remove the valve from the cylinder body except by competent persons fully conversant with the job.

16.3 Cylinders with defects shall be immediately labelled appropriately and returned to the supplier.

16.4 Marking and identification colour of a cylinder shall never be defaced.

16.5 If any incident occurs to the cylinder, the supplier shall be immediately informed giving the cylinder number, nature of the damage and if possible the reasons for the incident.

16.6 When there is a doubt in proper handling of the cylinder, the manufacturer or the supplier of the cylinder shall be consulted.

16.7 The cylinder shall not be filled with any other gas.

17. METHYL BROMIDE LEAKS

17.1 Methyl bromide leaks shall always be taken care immediately or they will become worse, since it is a colourless poisonous gas.

17.2 Corrective measures shall be undertaken only by trained men wearing proper safety equipment.

17.3 If the leak is large, all persons in the affected area shall be warned.

17.4 Leaky cylinder shall be moved quickly to a safe open area.

17.5 If methyl bromide is leaking as liquid, the cylinder shall be turned so that the leaking side is on the top.

17.6 Water shall not be poured on methyl bromide leak.

17.7 Leaks at valve inlet and body shall usually require special handling and emergency equipment.

17.8 Leaks around valve stems and valve discharge outlet shall be stopped by closing the valve or tightening the packing gland nut or replacing gaskets.

17.9 A leaking container shall not be transported.

17.10 Suitable gas masks with eye shields shall be available within easy reach whenever cylinders and containers are handled.

18. RECORDS

18.1 Filling station shall maintain the following record in respect of each cylinder examined and tested for filling:

- a) Name of the manufacturer and the owner;
- b) Cylinder number;
- c) Specifications to which the cylinder conforms;

- d) Date of original hydrostatic test;
- e) Test reports and certificates furnished by the manufacturer;
- f) Test pressure;
- g) Maximum working pressure;
- h) Water capacity in litres;
- j) Date of the last hydrostatic test;
- k) Tare and gross weight of the cylinder;
- m) Variation, if any, in the tare weight marked on the cylinder and actual tare weight at the time of hydrostatic test;
- n) Type of the valve fitted;
- p) Weight of the ammonia charged;
- q) Maintenance attended; and
- r) Remarks.

18.1.1 Permission obtained from the statutory authority permitting the use of cylinder shall be preserved till the cylinder is condemned.

A P P E N D I X A

(Clause 4.1)

LIST OF APPROVED SPECIFICATIONS*

A-1. The list of specifications approved by the statutory authority for use in India is given below:

IS : 7682-1975	Welded low carbon steel gas cylinders for methyl bromide gas
BS 401 : 1931	Steel cylinder for storage and transport of liquefied gases. British Standards Institution
BS 1500 : Part I : 1958 Class I	Fusion welded pressure vessels for general purposes. Carbon and low alloy steels. British Standards Institution
BS 1515 : Part I : 1965	Fusion welded pressure vessels (advanced design and construction) for use in chemical, petroleum and allied industries. Carbon and ferritic alloy steel. British Standards Institution

*This list is not comprehensive as new specifications are added from time to time. Up-to-date information on the subject can be had from the Chief Controller of Explosives, Nagpur.

IS : 8198 (Part X) - 1980

(Continued from page 2)

<i>Members</i>	<i>Representing</i>
SHRI B. J. DOODHMAL	Kosan Metal Products Pvt Ltd, Bombay
SHRI P. D. ARTE (<i>Alternate</i>)	
SHRI D. K. GARG	The Industrial Gases Ltd, Calcutta
SHRI S. L. ROY (<i>Alternate I.</i>)	
SHRI S. K. SANGAL (<i>Alternate II.</i>)	
SHRI J. N. GOSWAMY	Lloyd's Register of Shipping, Bombay
SHRI D. MADHOK (<i>Alternate I.</i>)	
SHRI H. T. PAVRI (<i>Alternate II.</i>)	
SHRI K. N. HARSH	Gannon Dunkerley & Co Ltd, Bombay
SHRI A. L. PADHYE (<i>Alternate</i>)	
SHRI ASHOK JAIN	ASCO Industrial Corporation, New Delhi
SHRI O. P. BHARGAVA (<i>Alternate</i>)	Indian Oxygen Ltd, Calcutta
SHRI D. S. MADAN	Chief Controller of Explosives (Ministry of Industry), Nagpur
SHRI I. N. MURTY	
SHRI CHARANJIT LAL (<i>Alternate</i>)	Hindustan Petroleum Corporation Ltd, Bombay
SHRI R. R. NAGARKATTI	
SHRI J. J. MEHTA (<i>Alternate</i>)	
SHRI T. NARASIMHA RAO	Hyderabad Allwyn Metal Works Ltd, Hyderabad
SHRI K. BALASUBRAMANIAN (<i>Alternate</i>)	
SHRI D. D. SHARMA	Indian Sugar and General Engineering Corporation Ltd, Yamunanagar
SHRI P. C. SILAOHIA	Bharat Petroleum Corporation Ltd, Bombay
SHRI R. P. GARG (<i>Alternate</i>)	